# EDUCATION

*This department publishes articles, notices, and news on programs and courses in history of mathematics, the uses of history in mathematics education, historical activities at meetings of mathematics teachers, and other matters relating to the place of our discipline in academic affairs.*

## REPORT ON A CONFERENCE FOR SECONDARY TEACHERS ON THE HISTORY OF MATHEMATICS

*By J. M. Mack, Sydney University*

A successful one-day inservice course for secondary teachers, entitled "The Use of History of Mathematics in the Teaching of Mathematics", was held in November 1977 at Sydney University. The course was proposed by the author on behalf of the Mathematical Association of N.S.W., and funded by the N.S.W. State Development Committee. A stimulus to proposing the course was provided by Dr. I. Grattan-Guinness's visit to Australia. The speakers were I. Grattan-Guinness, J. N. Crossley (Monash University), J. D. Gray (University of N.S.W.), R. W. Eyland and G. P. Monro (both from Sydney University), all of whom are involved with research in teaching of the history of mathematics. In advance, each speaker was given copies of the N.S.W. mathematics syllabi for years 11 and 12 (the final two years of secondary school), and was asked to direct their comments to the history of whatever subjects they might choose appearing in the syllabi. The speakers were also requested to stress elementary historical facts, since it was assumed that most of the audience would have little familiarity with historical issues.

The programme was opened by Dr. Grattan-Guinness, who gave a general survey of the use of history in understanding both the content and presentation of the syllabi. He suggested that one should compare the history of a subject with the way one is asked to (or decides to) teach it, and that one should also know something of the history of mathematics education and its relationship to pedagogical fads. He traced the latter development with regard to the teaching of analysis since the nineteenth century, and stressed the effect of the succession of *Traités* whose appearances focussed attention on the printed word rather than on the teaching methods practised by their authors. Summarising, he suggested that the overall result was an approach which favoured rigour, abstraction, generality, deduction and detailed attention to bases such as sets and limits. It was opposed to infinitesimals and to geometry, and largely indifferent to discovery or applications. Dr. Grattan-Guinness then examined the syllabi against this background and with respect to

the professed aims of each syllabus, providing critical comments on content and method.

The opening lecture was followed by two elective sessions separated by a lunch break. At each session four topics were offered, with three common to both sessions. The common topics were "Infinite Sums", "The Development of Complex Numbers" and "Formal Definitions of Limits". Dr. Gray discussed attitudes to infinite sums (especially in the eighteenth century). Among the numerous examples that were analyzed, the geometric series came up frequently in differently contexts. Clearly, many listeners derived deeper insights into the notion of convergence from this talk than they had from previous courses in real analysis. Dr. Monro spoke on the development of complex numbers and their historical relation to polynomial factorisation and to integration. He also discussed the controversy between Leibniz and Bernoulli over the logarithms of negative and complex numbers, and went on to describe Euler's contribution to their geometrical and algebraic representations. Such graphic presentations have the advantage of illustrating some of the conceptual problems that arose (and still arise) in using complex numbers in various parts of mathematics that initially use a real number background. Dr. Eyland traced various aspects of the evolution of the idea of limit, with particular attention to Newton's and Lagrange's ideas. This provided a historical context for formal definitions of limits which appear in several places in the syllabi, and which (not surprisingly) continue to pose problems to teachers and students alike. Teachers are often unaware that the history of calculus is liberally sprinkled with instances of the same conceptual problems that they find themselves confronted with in class. Much more needs to be done to give teachers a better understanding and knowledge of such subjects. (Recent Sydney University graduates have benefited enormously from a course on the history of the calculus introduced by Eyland and Monro .)

Additional topics concerning the calculus were explored by Grattan-Guinness in his elective session. Again, to many in the audience, his descriptions of infinitesimals, of the meanings of dy, dx, dy/dx, etc., as originally introduced, and of their use in calculation and theory, came as a *first* introduction to the "infinitesimal calculus". Professor Crossley gave an elective talk on the origins of set theory and mathematical logic, important in view of the recent insistence on using rather trivial aspects of these topics in primary and secondary mathematics.

The final address was given by Professor Crossley, on the early history of the solution of quadratic and cubic equations. (Quadratic expressions, equations and functions occur in separate parts of the syllabi, but cubic equations and general questions on the meaning of a solution to an equation have long since gone.)

He demonstrated that such simple facts as "completing the cube", meant literally what they said. His account of Bombelli's solution of the irreducible case of the cubic showed convincingly that Bombelli knew how to operate with his complex numbers.

The careful attention given by the speakers to preparing their talks, providing handouts, and coordinating their themes (so that ideas in calculus and analysis, and in complex numbers and the theory of equations, appeared throughout the programme) was responsible for the enthusiastic response given in return by the eighty-odd participants. The Mathematical Association of N.S.W., encouraged by the success of the day's programme, hopes to arrange similar courses in the future.

## A HISTORY OF MATHEMATICS COURSE FOR UNDERGRADUATES

*By James V. Peters,*
*St. Bonaventure University, St. Bonaventure, NY*

During the fall semester of last year I taught a History of Mathematics course to undergraduate mathematics majors at St. Bonaventure University. The eight students in the class were all seniors and the prerequisites for the course included advanced calculus, as well as abstract and linear algebra. This background was essential since most of the class time was spent discussing mathematics from 1826 to date. My choice of the course text "Development of Mathematics" by J. M, Dubbey was due, in part, to its emphasis on the more recent mathematics.

A focal point of this course was Hilbert's problems; in particular the first and the tenth. Discussion of both of these problems required a development of some aspects of mathematical logic. Specifically, models and independence of axioms come into play in the continuum hypothesis (Hilbert's first problem) and decidability in the tenth problem. Offering a resolution to the latter problem afforded the opportunity to outline Gödel's incompleteness theorem and mention the relatively recent results concerning the undecidability of general diaphantine equations.

The students in the class were required to submit term papers on some aspect of mathematics or some mathematician. In addition to this, an oral presentation based on the content of each paper was made in class. These presentations, which were chosen by the students themselves, provided a significant supplement to the material that I covered. Indeed, the majority of the papers concerned contributions to the early mathematics which I had gone through rather hastily. Their choice of such topics was to be expected, and, in fact, entered into the decision to emphasize the more conceptually difficult mathematics of the 19th and 20th centuries in my lectures as well as the final exam.

My own interests led to the discussion of two particular topics: geometries induced via transformation groups and